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EXPLORATIONS IN COMPUTER-ASSISTED COUNSELING.

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MODELS OF A SCHOOL COUNSELOR'S COGNITIVE BEHAVIOR IN THE APPRAISAL OF STUDENT INFORMATION AND OF HIS OVERT VERBAL RESPONSES IN THE "EDUCATIONAL PLANNING INTERVIEW" WERE MADE WITH COMPUTER PROGRAMS AND COMPUTER-CONTROLLED EQUIPMENT. THE VERBALIZATIONS OF THE COUNSELOR WHILE REVIEWING THE RECORDS OF 20 NINTH-GRADE STUDENTS PRIOR TO INTERVIEWS AND WHILE CONVERSING WITH THE STUDENTS DURING THE INTERVIEWS WERE USED TO CONSTRUCT THE MODEL. THE AUTOMATED INTERVIEW IS CONDUCTED BY A TELETYPE UNDER CONTROL OF A Q-32 COMPUTER IN A TIME-SHARING MODE. THIS AUTOMATED INTERVIEW PROGRAM WAS PLANNED TO REVIEW STUDENT PROGRESS, COLLECT COMMENTS FROM THE STUDENTS, REACT TO STUDENT PLANS, AND HELP THE STUDENT PLAN A SCHEDULE OF HIGH SCHOOL COURSES. TO ASSESS THE VALIDITY OF THE MODEL, THE AUTOMATED SYSTEMS WERE COMPARED TO THE RESPONSES OF THE ORIGINAL HUMAN COUNSELOR WITH A NEW SAMPLE OF 20 STUDENTS FROM THE SAME POPULATION. THE STUDY INDICATED THE POTENTIAL VALUE OF THE AUTOMATED PROCEDURE FOR BOTH RESEARCH AND FIELD APPLICATION. (TC)

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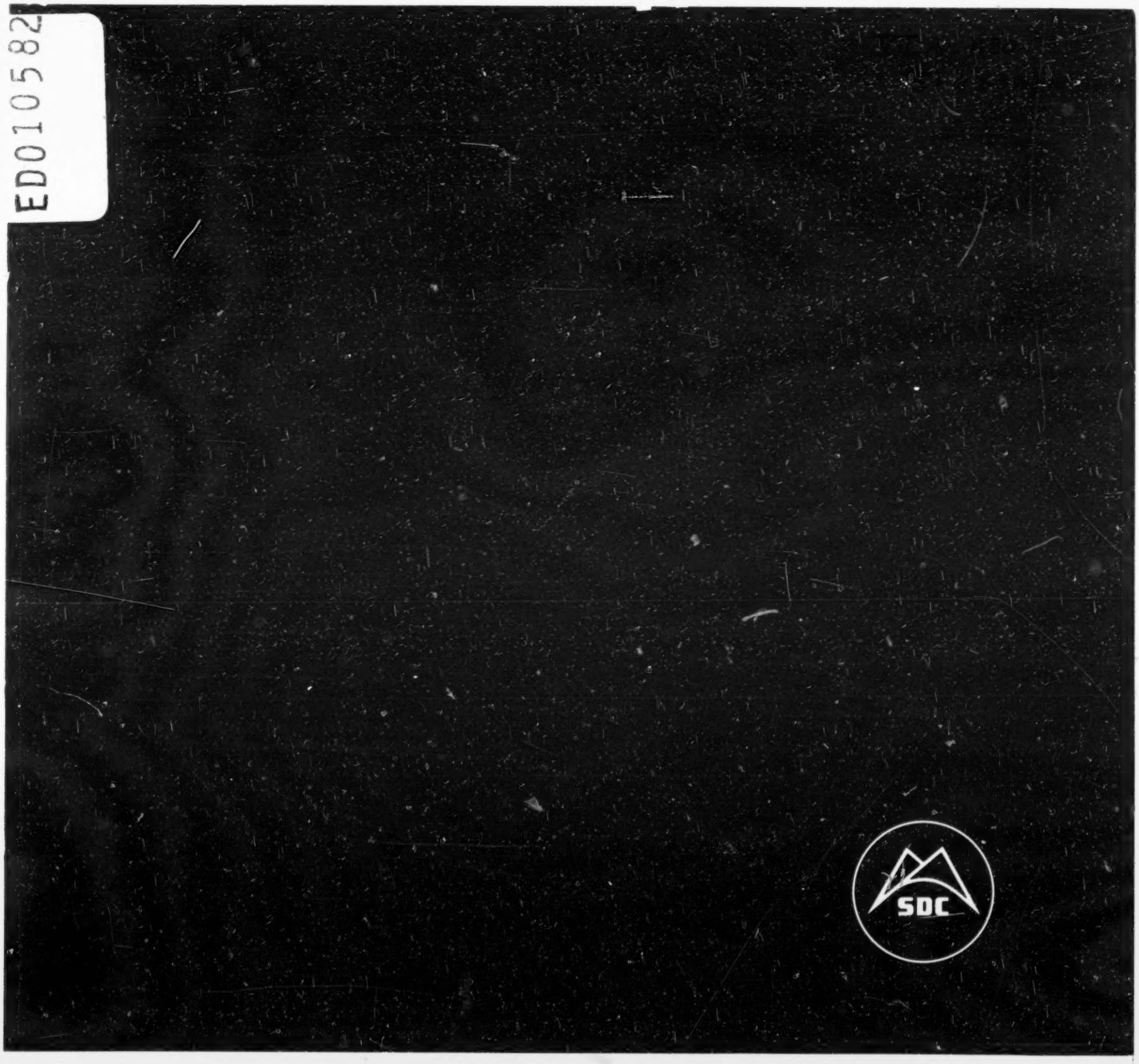

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ABSTRACT

Explicit models of a school counselor's cognitive behavior in the appraisal of student information and of his overt verbal responses in the educational planning interview were made with computer programs and computer-controlled equipment. The computer system was based on recordings of the counselor's verbalizations in two situations--as he thought aloud while analyzing the student cumulative records prior to interviews, and as he conversed with the student during the interview. The sample consisted of 20 ninth-grade students. A program on the Philco 2000 computer, representing the preinterview appraisal, accepts inputs such as school grades, test scores, and biographical data; analyzes the data according to the inferred model of the counselor's decision-making rules; and prints out statements such as "Student's grades have gone down quite a bit. Ask about this in interview. Possibly there are personal problems," or "Low counseling priority; no problems apparent." The automated interview is conducted by a teletype under control of the Q-32 computer in a time-sharing mode. This automated interview program reviews student progress, collects comments from the student, reacts to student plans, and helps the student plan a schedule of high school courses. To assess the validity of the model, the automated systems were compared to the responses of the original human counselor with a new sample of 20 students from the same population. The study indicates the potential value of the automated procedure for both research and field application.

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Explorations in Computer-Assisted Counseling*

INTRODUCTION

For some time now, the idea that electronic data-processing techniques could be applied to the routine clerical tasks in education has been accepted. We have witnessed a widespread application of these techniques to attendance accounting, grade reporting, and making master schedules.

These foregoing applications pertain to tasks that lie on the periphery of instruction and counseling. Their main effect is to save human time, which can then be spent on tasks requiring judgment and sensitivity. While it seems fairly certain that the automation of scheduling will eventually lead to more flexible instructional programs, the current efforts are aimed primarily at constructing the rigid master schedule associated with the lockstep system.

A different and more challenging hypothesis is that the value of electronic information-processing techniques will increase as they are more directly applied to the central functions of instruction and counseling. The purpose of this document is to examine some of the paths our research has begun to explore in this direction.

SDC STUDY

We will begin by describing a study that was conducted on the application of automated techniques to tasks of central importance in counseling. The area selected for study was the educational planning function; the procedure employed was to simulate by computer as much as possible of a counselor's behavior in two phases of educational planning: the appraisal of the cumulative folder and the planning interview with the student.

The study was patterned in some respects after the procedures employed by Kleinmuntz (1962).** In his study, he simulated the profile analysis behavior of an interpreter of the Minnesota Multiphasic Personality Inventory Test (MMPI).

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*The work described in this document was partially supported by Grant 7-14-9120-217, Office of Education, U.S. Department of Health, Education and Welfare. A number of people participated in the work. In addition to the authors, they were: Dr. John Loughary, Oregon System of Higher Education; Mr. Robert Hurst and Mr. Donald Friesen, University of Oregon.

**B. Kleinmuntz. Personality test interpretation by digital computers. Science, 139 (3553), 1963. 416-418.

The profiles of 126 students from Carnegie Institute of Technology were used for the input sample. Forty-five of the students were called the "maladjusted group," either because they came into the counseling center and talked about emotional problems or because they were identified by a majority of their sorority/fraternity peers as one of the two "most maladjusted" members of the chapter.

The profiles of the 126 students were given to ten MMPI interpreters, who were asked to sort for the adjusted and the maladjusted students. The clinician who had the highest number of hits with the lowest error rate was picked for further study. Kleinmuntz spent approximately 30 hours with the expert, or "winner," listening and recording while the interpreter verbalized his thinking as he repeated the sorting task many times. On the basis of this sample of the interpreter's behavior, a 16-rule program was developed at Carnegie Tech to simulate the sorting task on a computer. The first version of the program did not perform quite as well as the clinician. Kleinmuntz used the explicit model as a basis for building a more elaborate model through trial and error. He eventually developed a refined computer program, with 35 rules, which performed better than the expert MMPI interpreter. On cross-validation studies at five other colleges, the "hit rates" of the revised model were about as high as those of the human expert on the original sample.

Kleinmuntz's study demonstrated several interesting points: it showed that clinical behavior could be simulated on computer; it provided support for the idea that the procedures of building a model by computer simulation yields a more explicit statement of diagnostic behavior than can be provided by a verbal description, and it suggests a way of systematically making use of clinical interpretation for prediction purposes.

Although we have patterned our procedure for obtaining the sample of the counselor's behavior after Kleinmuntz, our study differs in a number of ways. We were not interested in demonstrating that we could build a model that would be better than a counselor. No external criteria by which we could compare the machine against the human were defined. By the same token we did not select a counselor for study on the basis of his performance in a criterion situation. Our intention in this first study was to explore the terrain--to identify some of the major problems, both in regard to defining areas for further research and in methodology. Our study, because of its exploratory nature, was also aimed at a much broader spectrum of counselor behavior. We were trying to simulate both a counselor's behavior in the appraisal of the total cumulative record, and his behavior in the educational planning interview. We hoped that the study, in addition to suggesting further areas for research, would provide some concrete information about the kinds of man-machine systems that can be designed for counseling services.

Before selecting a counselor, we were concerned with several problems. Could a counselor be selected in terms of some external criterion? We decided that, since we wanted to study such a broad spectrum of the counselor's behavior,

there were no existing criteria for operationally defining the "best" counselor. We decided instead to study counselors who were considered "good" by their supervisors.

A second question concerned the generalizability of our study. We had made recordings of the verbalized "thoughts" of counselors from different parts of the country as they engaged in the cumulative folder appraisal task. These pilot studies made it apparent that there are fairly wide differences among counselors. Some counselors concern themselves almost entirely with the data in the cumulative folders; others talk about the phenomenal experiences of the student as expressed in previous counseling interviews. We considered the idea of studying several counselors at the same time, with the notion that we might build something more general from these procedures, but finally concluded that for this first exploratory study we should examine one counselor intensively. We decided to select an experienced counselor who habitually used the data in the cumulative folder in his appraisal; the data in unexamined cumulative folders would then provide a concrete and fairly standardized data base with which to evaluate the behavior of our simulated model.

Since the task was to help ninth-grade students in their planning for high school, we picked a counselor who had experience in this task and who also worked at the high school level. Our rationale for the latter decision was the assumption that a counselor who had worked with high school students might, consciously or unconsciously, have developed better predictive rules from exposure to the students in the criterion situation.

The counselor selected for the study had long experience as a counselor in the Palo Alto School District, was identified by the Director of Guidance and the Director of Research of the school district as one of their best counselors, and was also working as a vice-principal in one of the high schools.

The following procedures were employed in the data collection. The cumulative folders of 20 ninth-grade students were randomly selected for the study. The counselor was instructed to think aloud as he read through the data in each folder. He was asked to select the data he felt were important and to address himself to the following problems:

1. What broad goals should the student consider?
2. What problems, if any, does the student have?
3. What additional information would be desirable?
4. If problems are apparent, what causes might be hypothesized?
5. What things might the school do to help the student?

The only other instructions given to the counselor were that he should notify us when he was about to express his conclusions and that he should label these as his "output" statements since we wanted to use these statements, word for word if possible, as the output statements of the computer program.

Following the appraisal of the cumulative folders, the counselor called the students in for a regular educational planning interview, during which the students made out a program of courses for high school.

The separation of the appraisal from the interview was somewhat artificial. Most counselors, including the subject of this study, make their detailed appraisal during the interview and not prior to it. However, the artificial distinction was necessary for the study.

The recordings were transcribed and analyzed. A model of the counselor's decision rules in the appraisal task and another model of his behavior in the interview were defined for computer simulation. The cumulative folder appraisal program was written for the Philco 2000 computer.

The automated cumulative folder appraisal system accepts as inputs the data in the cumulative folder--grades, aptitude test scores, parents' occupation, etc. The program analyzes these data, applying the programmed "rules" abstracted from the counselor's verbal behavior, and selects output statements such as the following:

> "Student's grades have gone down quite a bit. Ask about this in interview. Possibly there are personal problems."
>
> "Student should be watched closely. He will probably need remedial courses."
>
> "Student is a potential dropout."
>
> "Low counseling priority. No problems apparent."

(Appendix A contains the logical flow chart used for the automated cumulative record appraisal program.)

In the automated interview, the student-program interaction takes place through the medium of a teletypewriter connected to a Q-32 computer. Figure 1 shows a student using the teletype.

The interview goes through the following procedures. (Appendix B provides the actual printout of an interview that was conducted during the evaluation study described below.) First, using conventional computer-based programmed instruction techniques, the student is given a 5-minute lesson on use of the teletype. Next, the student's cumulative folder record is inspected and the machine types out the student's courses and grades for the last semester and asks the student

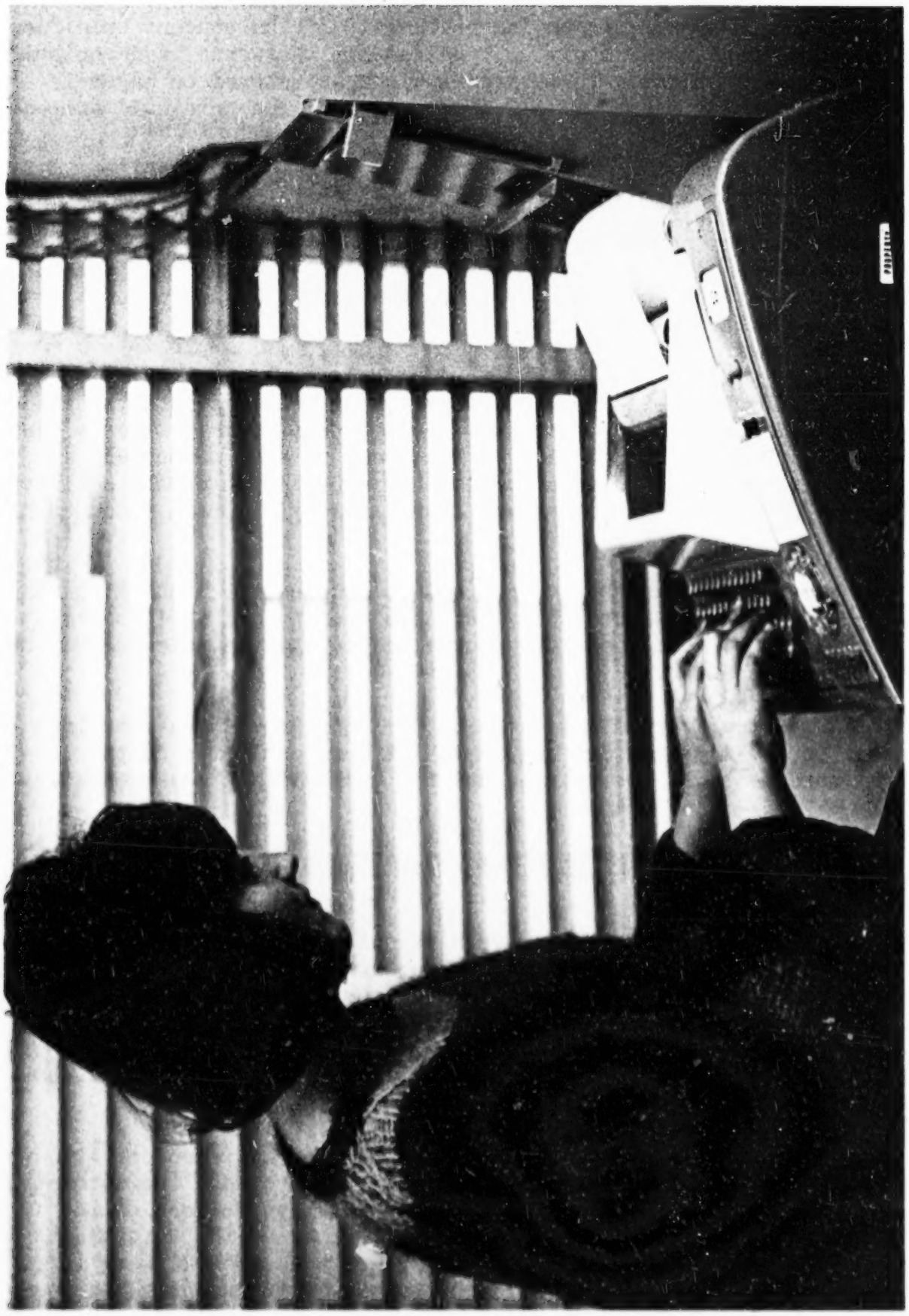

FIGURE 1. STUDENT TAKING THE AUTOMATED COUNSELING INTERVIEW ON A TELETYPE THAT IS UNDER COMPUTER CONTROL.

to indicate courses in which he is having problems. If the student specifies problem courses, the machine asks him to type, in his own words, a description of the problem for each course. These descriptions are stored on magnetic tape and later are printed out on an off-line printer. The printouts are sent to the counselor.

Following the description of problems, the machine asks the student if he would like to stop the interview to go see his counselor or if he would like to continue. If the student continues, his goals are explored next. The machine asks if the student plans to go to college. If he does, the program assists him in selecting the type of college he hopes to attend. If he does not, the student and the computer explore vocational alternatives in order to establish the student's vocational interests.

Following the selection of college or vocation, the machine assists the student in determining his major field of interest. The student is then given a statement regarding the probable grades that he will make in high school and a statement about his chance of success in his chosen post-high-school activity. These predictions are based on statistics accumulated by the Palo Alto School System.

Then the machine requests that the student select courses for 10th, 11th and 12th grades. The machine evaluates the student's choices and advises him regarding required courses, appropriate course loads, and the relevance of his electives to his chosen major.

Throughout the interview, records are kept by the program and, when certain critical events occur, messages are composed. At the conclusion of the interview, all such messages are printed out for transmittal to a counselor.

EVALUATION OF THE AUTOMATED PROCEDURES

An investigation was conducted between March 22 and March 26, 1965, to assess the simulation and to appraise student acceptance of the automated interview. Forty 9th-grade students were randomly selected from the population of 9th-grade students at the Wilbur Junior High School in Palo Alto, California. The students' total Scholastic and College Aptitude Test scores ranged from the third percentile to the ninety-sixth percentile. The group is somewhat above the national average in aptitude.

A teletype was installed at the school and was connected by telephone line to the Q-32 computer at SDC in Santa Monica. All 40 students took the automated interview. In addition, all of the data in the cumulative folders of the 40 students were analyzed by the appraisal program. Twenty of the 40 students were also interviewed by the original counselor, and the other 20 were interviewed by a second counselor. The second counselor was included in the study to provide some estimate of the generality of the model.

To control the effects of sequence and order, each group of 20 was further divided into two subgroups of ten. One group of ten students went to the computer first for the interview and then went to the counselor. The other group of ten saw the counselor first and then was interviewed by the computer.

Following each interview, either by human or machine, the students were given an opinion questionnaire designed to measure their attitudes toward the interview. When each student had completed both the human and the machine interviews, he was given a standardized interview to obtain more detailed information on his attitudes toward the machine and human interviews.

The results of the study are summarized in four broad categories: (1) those areas in which there appeared to be no marked difference between the counselor and the automated systems; (2) those areas where differences were observed between the automated systems and the counselor; (3) findings on the reaction of students to the automated procedure; and (4) areas that require further study.

1. Areas of no difference between automated systems and counselor. No significant differences were found between the appraisal behavior of the two counselors and the computer appraisal programs on three-fourths of the appraisal statements. Both human and computer performed similarly in terms of identifying the following: changes in the pattern of student's grades; underachievement; overambitious plans; need for remedial work; appropriate and inappropriate post-high-school plans.

2. Areas of difference between automated systems and the counselor. The automated appraisal programs identified significantly more students as over-achievers and as potential dropouts than did either of the two counselors. Both of these differences were clearly attributable to the fact that the computer program was generally more pessimistic in predicting the future achievement of students in the lower aptitude levels. A modification of the computer program to change this one function would produce a much greater similarity between the counselors and the automated procedures.

(It was the feeling of the researchers that the computer program provided an excellent model for studying some of the counselor's decision rules. Following the study there was a strong subjective feeling of confidence that the procedure also provided a good way of understanding the counselor's appraisal behavior.)

The schedules made by the students under the automated conditions tended to differ from the schedules made with the counselor present. This was true not only for the specific courses which were selected but also in the number of course schedules that were completed. In this latter sense, the computer was more permissive than the counselors. It did not compel the student to make a complete program of courses nor did it compel him to make any attempt at preparation of a program.

Two interesting differences showed order effects. When the machine interview was administered first, there were greater differences between the schedule produced with machine and the schedule produced with the counselor than occurred when the counselor interview was first. A number of observations led to the conclusion that the counselor exerted more influence on the students than did the interview program.

Also, a significantly larger number of students expressed concern over problems to both counselor and machine when the machine interview occurred first in the sequence. This difference may be attributable to the fact that the computer interview always asked students if they had problems, while the counselors may not have asked. In addition, some students stated emphatically that they felt that the confidentiality of the machine interview was a strong point in its favor.

3. Reaction of students to the automated procedure. Different sets of attitude questions were presented following the automated interview and the human counseling interview. The questionnaire items were tailored to the two different situations. Although no direct comparison can be made at this time, the mean scores on both the post-machine scale and the post-human counseling scale tended to be in the positive direction. The scoring was such that if one-half the items were answered negatively and one-half positively, the total score would be 90 on either of the two scales. The actual mean score for the students on the post-machine interview scale was 105, and the actual mean score for the students on the post-human counselor scale was 119. There were wide individual differences among students in each group. A few students seemed to react very positively to the machine and a few expressed a strong preference for the counselor.

In the standardized post-interview, 53 per cent of the students indicated that the machine was not able to take into consideration all of the data necessary to make adequate plans for high school. Most of these students felt the machine did not give enough consideration to personal interests and personality variables.

Fifty-six per cent of the students expressed some reservation about course plans made with computer assistance, whereas only 20 per cent had reservations about course plans made with the counselor.

Six per cent of the students reported that the computer interview bored them and made them restless; 26 per cent of the students felt bothered by the fact that the computer did not give them any reassurance as to whether their choices were appropriate.

Only one of the 40 students in the study chose to terminate the machine interview before making 10th-year course plans.

4. Problems for future study. The results of the pilot study indicate that simulation of logical appraisal procedures is more easily achieved than automation of complex interviewing procedures. It would seem from analysis of the data that further study of the appraisal process should consider how the counselor's appraisal decisions based on the quantitative data are modified by the interview.

One of the counselors in the pilot study was from the Wilbur Junior High School in which the study was conducted. The other counselor (the original counselor) was from another school. Of the total number of appraisal statements made by the counselor who knew the students (97 statements), 42 per cent (41 statements) were also made by the computer model. Of the total number of appraisal statements made by the original counselor (53), 77 per cent (41 statements) were also made by the computer model. This result suggests that the computer model better represents the original counselor. However, the difference may also be attributed to the fact that the counselor from Wilbur Junior High School had more data. Examination of her responses indicated that she was using additional data obtained from first-hand knowledge of the students.

The automation of interview functions needs further study. The study indicates that more than one iteration is required in the analysis and design process to achieve accurate simulation. Most of the differences in the output of the human and the machine interviews could be resolved by a small number of cycles of program modification and system test with another sample of students. However, the problem involves more than accurate simulation or reduction in differences. The data on student reaction suggest that there are individual differences among students in their response to the automated system. The data also suggest that there are sequence effects that should be considered. In some cases, a period of time spent on the machine may make the student more productive in the interview with the counselor. In other cases, the contrast between machine and human could make the student more dependent upon the human. Further study of the machine interview versus the human counselor does not seem advisable. The question should not be that of which is better, but how and to what extent can automated interviewing be successfully integrated into the counseling process. The pilot studies indicate that automated interviewing procedures can be developed. Adequate field study is required to acquire some basis for recommending how such procedures as automated appraisal, and automated interviewing, can be used in actual counseling practice.

An unanticipated result of the work done so far on the automated interview has been the initial design of an advanced integrated student-information system. The student-information system currently has the following features: a student-information data base; an information input system for updating the student-information base through teletype stations; an information retrieval system for printing out student data on the teletype; and the associated programs for appraising the data and conducting the automated educational planning interview.

The student-information data base contains all of the relevant information on the student. At the present time, the stored data are those usually contained in the cumulative folder. However, the information input procedure would permit a teacher, counselor, or other appropriate personnel to modify the data base for any student by adding, changing, or deleting information. This system, in a real school environment, would possibly consist of input/output teletypes placed at appropriate spots in the building. An up-to-date student data base could be maintained simply by typing in relevant new information as it became available. The system is currently programmed so that personnel must know a set of code symbols to retrieve information from the student-information base. Anyone knowing the code can get an immediate listing of information available about any student.

FUTURE PLANS

Future development of the retrieval system will allow the person requesting information to select it by category. Different codes and displays will also be developed for students, teachers, and counselors, so that the student will be able to obtain appropriate screened information of value to himself when he needs it. The data currently stored in the student-information data base can be thought of as "primary data," i.e., data that are essentially unprocessed and unanalyzed. The student-information data base will be expanded to include information resulting from further processing of the primary data, which can be thought of as "secondary data," for example, the output statements similar to those produced by the counseling appraisal program.

At the present time both the counseling appraisal program and the automated educational planning interview use the student-information data base. Other programs will be added to the system. A student tracking system that follows student progress and provides displays to students, teachers, and counselors when the student's performance falls below "expected" levels, will be integrated into the total system. The system will be further enlarged to include numerous other functions, such as diagnostic interviewing and testing; computer-assisted instruction, real-time, flexible, scheduling and control programs that solve scheduling problems on a continuous basis, etc.

We are planning as our next experimental step the development of a man-machine counseling system in a real educational setting. (Appendix C describes a hypothetical man-machine counseling system for illustrative purposes.) We hope to study counselors at a selected field site and to build computer programs for automating some of their functions, such as appraisal. The programs will be adapted to the particular styles of the various counselors at the field site. We view this effort as a three-year study. The first year of work will produce an initial system design in the laboratory. During the second year we will test the first version and revise it until it meets prestated objectives. The third year will involve training the personnel to

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use the system; testing the procedures, especially those relating to the interface between the man and the machine; and implementing the system in the field. Following implementation, an evaluation of the installed system will be made.

Once the system has been developed and installed, it will provide an excellent vehicle for research studies aimed at improving these systems in general. In addition, the problem of implementing the system in other field settings--i.e., the problem of generalizability--can be further explored.

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APPENDIXES

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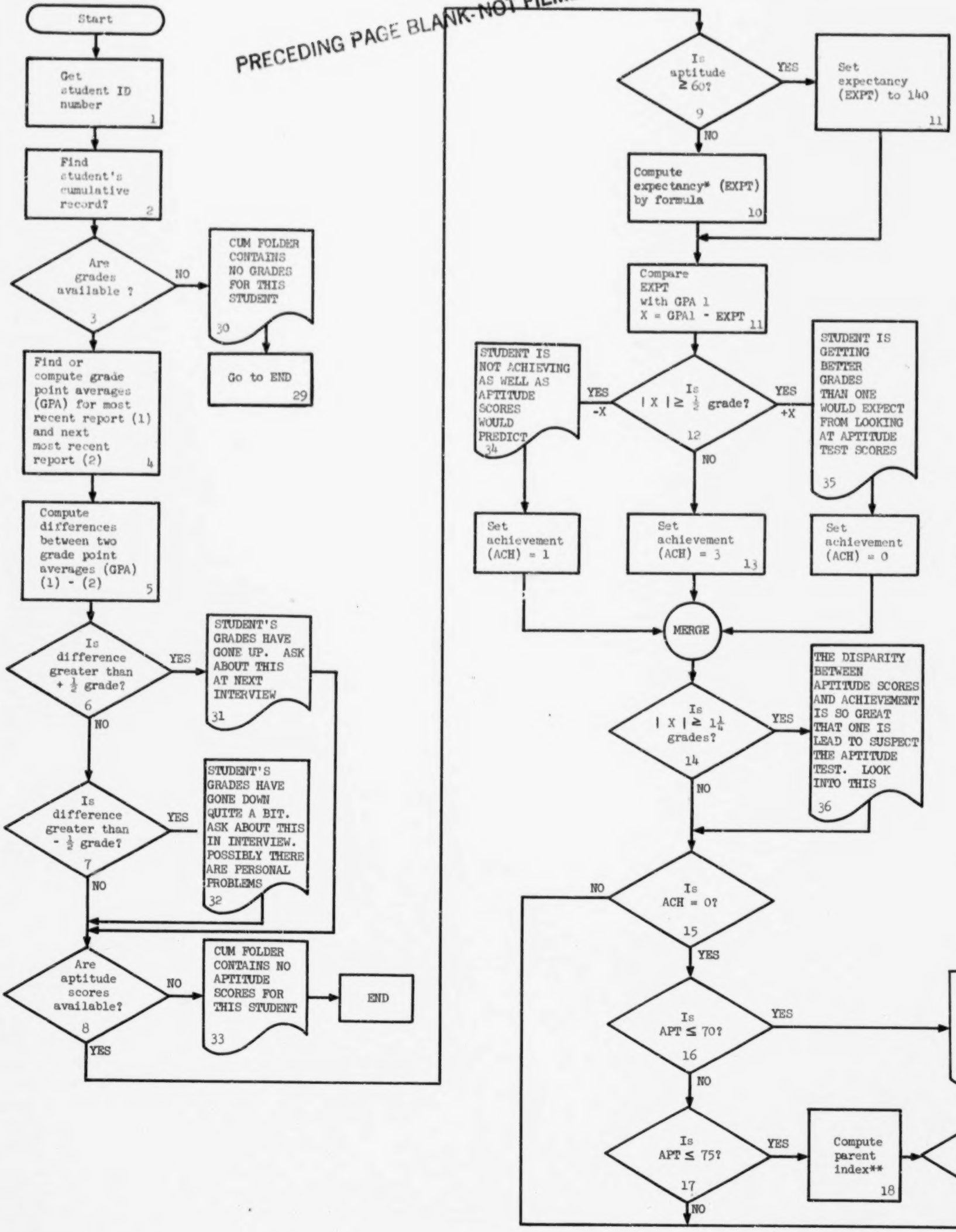
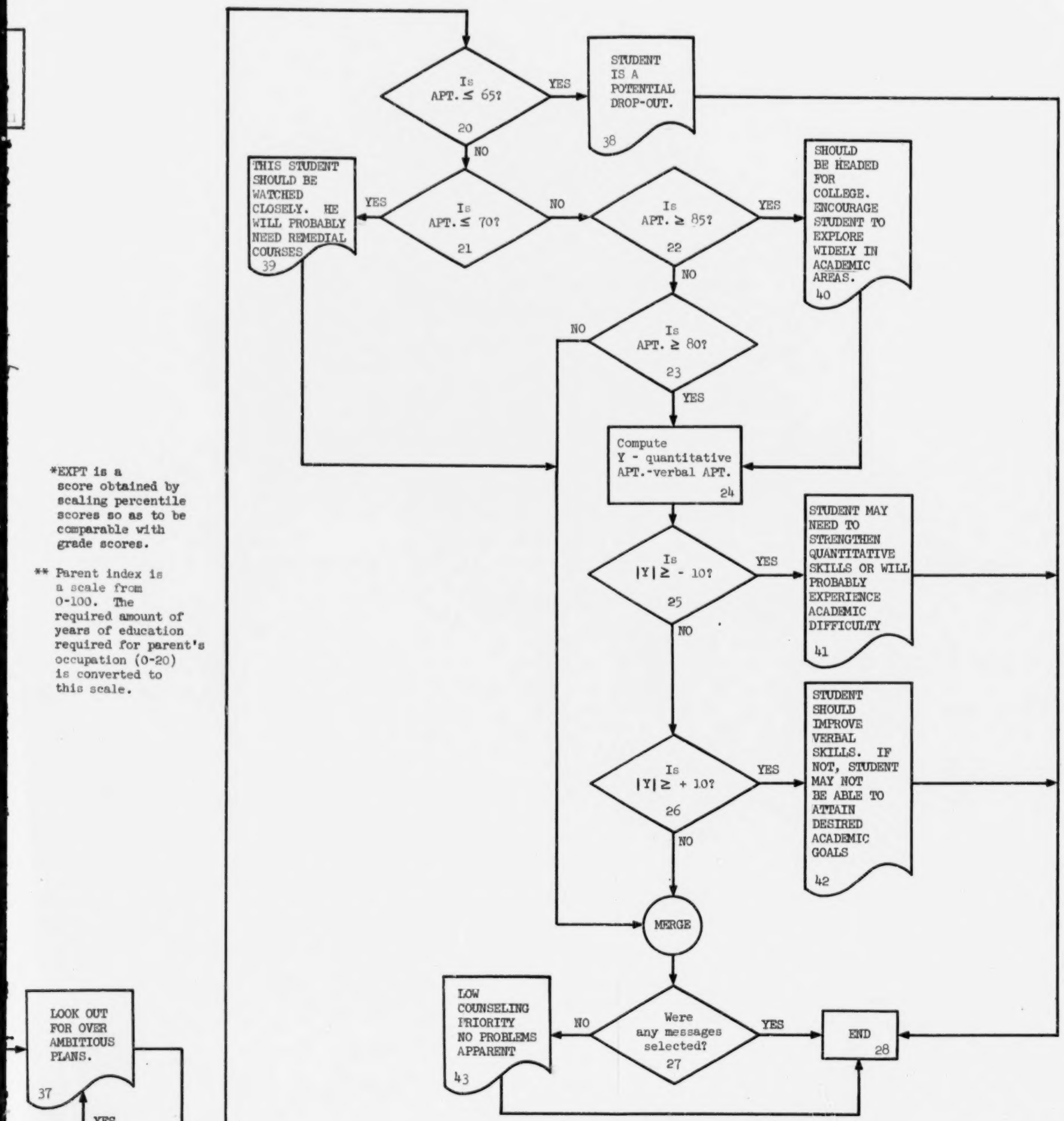

Start
Get student ID number 1
Find student's cumulative record? 2
Are grades available ? 3
NO
CUM FOLDER CONTAINS NO GRADES FOR THIS STUDENT 30
Go to END 29
Find or compute grade point averages (GPA) for most recent report (1) and next most recent report (2) 4
Compute differences between two grade point averages (GPA) (1) - (2) 5
Is difference greater than + ½ grade? 6
YES
STUDENT'S GRADES HAVE GONE UP. ASK ABOUT THIS AT NEXT INTERVIEW 31
NO
Is difference greater than - ½ grade? 7
YES
STUDENT'S GRADES HAVE GONE DOWN QUITE A BIT. ASK ABOUT THIS IN INTERVIEW. POSSIBLY THERE ARE PERSONAL PROBLEMS 32
NO
Are aptitude scores available? 8
NO
CUM FOLDER CONTAINS NO APTITUDE SCORES FOR THIS STUDENT 33
END
YES
Is aptitude ≥ 60? 9
YES
Set expectancy (EXPT) to 140 11
NO
Compute expectancy* (EXPT) by formula 10
Compare EXPT with GPA 1 X = GPA1 - EXPT 11
Is | X | ≥ ½ grade? 12
YES -X
STUDENT IS NOT ACHIEVING AS WELL AS APTITUDE SCORES WOULD PREDICT 34
YES +X
STUDENT IS GETTING BETTER GRADES THAN ONE WOULD EXPECT FROM LOOKING AT APTITUDE TEST SCORES 35
NO
Set achievement (ACH) = 1
Set achievement (ACH) = 3 13
Set achievement (ACH) = 0
MERGE
Is | X | ≥ 1¼ grades? 14
YES
THE DISPARITY BETWEEN APTITUDE SCORES AND ACHIEVEMENT IS SO GREAT THAT ONE IS LEAD TO SUSPECT THE APTITUDE TEST. LOOK INTO THIS 36
NO
Is ACH = 0? 15
NO
YES
Is APT ≤ 70? 16
YES
LOOK OUT FOR OVER AMBITIOUS PLANS. 37
NO
Is APT ≤ 75? 17
YES
Compute parent index** 18
Is parent index ≥ 80? 19
YES
NO

*EXPT is a
score obt
scaling p
scores so
comparabl
grade sco

** Parent in
a scale f
0-100. T
required
years of
required
occupatio
is convert
this scal


Is APT. ≤ 65? 20
YES
STUDENT IS A POTENTIAL DROP-OUT. 38
NO
THIS STUDENT SHOULD BE WATCHED CLOSELY. HE WILL PROBABLY NEED REMEDIAL COURSES 39
YES
Is APT. ≤ 70? 21
NO
Is APT. ≥ 85? 22
YES
SHOULD BE HEADED FOR COLLEGE. ENCOURAGE STUDENT TO EXPLORE WIDELY IN ACADEMIC AREAS. 40
NO
Is APT. ≥ 80? 23
NO
YES
Compute Y - quantitative APT.-verbal APT. 24
Is |Y| ≥ - 10? 25
YES
STUDENT MAY NEED TO STRENGTHEN QUANTITATIVE SKILLS OR WILL PROBABLY EXPERIENCE ACADEMIC DIFFICULTY 41
NO
Is |Y| ≥ + 10? 26
YES
STUDENT SHOULD IMPROVE VERBAL SKILLS. IF NOT, STUDENT MAY NOT BE ABLE TO ATTAIN DESIRED ACADEMIC GOALS 42
NO
MERGE
LOW COUNSELING PRIORITY NO PROBLEMS APPARENT 43
NO
Were any messages selected? 27
YES
END 28
LOOK OUT FOR OVER AMBITIOUS PLANS. 37
YES
Is parent index ≥ 80? 19
NO

*EXPT is a score obtained by scaling percentile scores so as to be comparable with grade scores.

** Parent index is a scale from 0-100. The required amount of years of education required for parent's occupation (0-20) is converted to this scale.

APPENDIX A. DECISION RULES FOR COUNSELOR APPRAISAL OF STUDENT DATA

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APPENDIX B

COPY OF SAMPLE INTERVIEW

YOU ARE ABOUT TO PARTICIPATE IN AN INTERVIEW WITH AN
AUTOMATED COUNSELOR.
THE COMPUTER WILL HELP YOU PLAN WHAT YOU WANT
TO DO IN HIGH SCHOOL AND IN LATER LIFE.
BUT FIRST, JUST TO LET THE COMPUTER KNOW YOU ARE THERE
PLEASE TYPE THE LETTER A AND A CARRIAGE RETURN
(RED KEY ON THE RIGHT-HAND SIDE OF THE KEYBOARD).

**** A
GOOD...
THE MOST IMPORTANT KEY IS THE CR KEY (RED KEY ON THE RIGHT).
YOU WILL USE IT TO LET THE COMPUTER KNOW THAT YOU HAVE MADE
AN ANSWER. JUST FOR PRACTICE, TYPE THE LETTER B AND CR (RED KEY).

**** B
OK.....
SOMETIMES YOU WILL BE ASKED TO ANSWER A YES OR NO QUESTION.
WHEN YOU ARE, JUST TYPE YES OR NO AND A CR
DON'T FORGET THE CR.
LET'S TRY IT. HERE IS A QUESTION---
ARE YOU IN CALIFORNIA NOW?
PLEASE TYPE YES OR NO.

**** YES
FINE..

MANY OTHER PEOPLE ARE USING THIS COMPUTER RIGHT NOW.
ONCE IN A WHILE THE COMPUTER WILL HAVE TO TAKE CARE OF THEIR
URGENT NEEDS. WHEN THIS HAPPENS, YOU MAY FIND THAT YOU
HAVE TO WAIT A MOMENT OR TWO. DON'T WORRY, THE COMPUTER WILL
COME BACK TO TAKE CARE OF YOU AS SOON AS IT CAN.
WHEN YOU HAVE READ THIS, TYPE OK AND CR.

**** OK
GOOD.
BY NOW YOU HAVE NOTICED THAT BEFORE YOU TYPE AN ANSWER,
THE TYPEWRITER TYPES STARS LIKE THIS-

****
THIS IS TO LET YOU KNOW THAT IT IS TIME FOR YOU TO TYPE
SOMETHING. YOU SHOULD NEVER TYPE ANYTHING UNTIL AFTER THE STARS
ARE TYPED OUT BY THE COMPUTER.
DO YOU UNDERSTAND?
PLEASE TYPE YES OR NO.

```
**** YES
ANOTHER VERY IMPORTANT KEY IS THE  /  OR ''SLASH'' KEY.
IT IS THE GREEN KEY ON THE BOTTOM RIGHT OF THE KEYBOARD.
LOOK FOR THE  /  KEY (GREEN KEY).  WHEN YOU FIND IT,
TYPE  /  AND  CR.

**** /
SOMETIMES YOU WILL HAVE TO TYPE MORE THAN ONE LINE AND THE
COMPUTER CANNOT TELL IN ADVANCE HOW MANY LINES YOU WILL TYPE.
IN SUCH A CASE, YOU WILL LET THE COMPUTER KNOW THAT YOU HAVE
FINISHED BY TYPING  /  AND  CR.
WHAT YOU TYPE WILL LOOK SOMETHING LIKE THIS---

**** 1

**** 2

**** /

LET'S TRY IT.
TYPE  1 AND  CR,  2  AND  CR, AND  /  AND  CR.
(WAIT FOR THE STARS.)

**** 1

**** 2

**** /
FINE..

PLEASE TYPE YOUR ID NUMBER AND A CR

**** 42
ONE MOMENT, PLEASE.

IS YOUR NAME  DEBORA ANDERSON

**** YES
ACCORDING TO MY RECORDS THIS IS HOW YOU DID LAST SEMESTER.
  CODE    COURSE           GRADE
    1   P.E.               A
    2   ENGLISH 1          A
    3   GENERAL SCIENCE    A
    4   EUROPEAN HISTORY   C
    5   ALGEBRA            B
    6   SCHOOL SERVICE     A

IS THIS CORRECT?  IF SO, TYPE  YES  IF NOT, TYPE  NO
```

**** YES
ARE YOU HAVING ANY PROBLEMS WITH ANY OF THESE COURSES?
PLEASE TYPE YES OR NO.

**** YES
TYPE THE NUMBER OF EACH COURSE THAT IS GIVING YOU TROUBLE.
TYPE CR AFTER EACH NUMBER.
WHEN YOU ARE ALL THROUGH, TYPE / AND CR.

**** 4

**** /
WHAT KIND OF PROBLEM DO YOU HAVE WITH EUROPEAN HISTORY
PLEASE TYPE IN THE NATURE OF THE PROBLEM. A FEW WORDS WILL BE O.K.
WHEN YOU ARE ALL FINISHED, TYPE / AND CR.

**** I DON'T TURN MY WORK IN ON TIME./
I SEE...
IF YOU WOULD LIKE TO DISCUSS THIS PROBLEM FURTHER,
MAKE AN APPOINTMENT TO SEE YOUR COUNSELOR.

WOULD YOU LIKE TO CONTINUE WITH THIS INTERVIEW AT THIS TIME, OR WOULD
YOU LIKE TO DISCUSS YOUR PROBLEMS WITH YOUR COUNSELOR BEFORE YOU CONTINUE?
TYPE GO IF YOU'D LIKE TO CONTINUE. TYPE STOP IF YOU'D LIKE TO STOP.

**** GO
DO YOU PLAN TO CONTINUE YOUR FORMAL EDUCATION BEYOND HIGH SCHOOL?

**** YES
WHICH OF THE FOLLOWING IS MOST LIKE THE SCHOOL YOU PLAN TO ATTEND?
1 IVY LEAGUE COLLEGE
2 OTHER COLLEGE OR UNIVERSITY
3 CALIFORNIA STATE COLLEGE
4 JUNIOR COLLEGE
5 BUSINESS OR VOCATIONAL SCHOOL
6 I HAVE NOT YET DECIDED
TYPE THE APPROPRIATE CODE.

**** 3
DO YOU INTEND TO MAJOR IN ENGINEERING OR ONE OF THE SCIENCES?
PLEASE TYPE YES OR NO.

**** YES
HERE ARE SOME AREAS OF SCIENCE AND SOME EXAMPLES

CODE	AREA	EXAMPLES
1	PHYSICAL SCIENCES.....	PHYSICS, CHEMISTRY, GEOLOGY, ETC.
2	BIOLOGICAL SCIENCES...	BIOLOGY, PRE-MED, PRE-NURSING, ETC.
3	SOCIAL SCIENCES.....	PSYCHOLOGY, SOCIOLOGY, ANTHROPOLOGY, ETC.
4	MATHEMATICS.....	MATH, STATISTICS, COMPUTER PROGRAMMING, ETC.
5	ENGINEERING.....	ARCHITECTURE, DRAFTING, ELECTRONICS, ETC.

PLEASE TYPE THE CODE NUMBER OF THE KIND OF SCIENCE YOU INTEND
TO MAJOR IN.

**** 3
ALRIGHT. LET'S SEE IF WE CAN PINPOINT YOUR AREA
1 PSYCHOLOGY
2 SOCIOLOGY
3 ANTHROPOLOGY
4 SOCIAL WORK
TYPE THE APPROPRIATE CODE.

**** 1
OK.....
THE GRADES YOU GET IN HIGH SCHOOL LARGELY DETERMINE THE TYPE OF
COLLEGE YOU WILL BE ABLE TO ATTEND.
LET'S JUST TAKE A LOOK AT YOUR PROJECTED HIGH SCHOOL GRADES
BASED ON YOUR PRESENT PERFORMANCE.
STUDENTS WHO GOT GRADES LIKE YOURS IN JUNIOR HIGH,
DID AS FOLLOWS AT CUBBERLEY---

70 PER CENT EARNED A OR B
20 PER CENT EARNED C+
10 PER CENT EARNED C

ON THE BASIS OF YOUR PROJECTED GRADES, YOUR PRESENT COLLEGE CHOICE
INDICATES THAT YOU ARE THINKING PRETTY REALISTICALLY ABOUT YOUR
FUTURE LIFE.

NOW THAT WE'VE GOT SOME IDEA OF WHAT YOU'D LIKE TO DO
AFTER HIGH SCHOOL, LET'S LOOK AT YOUR HIGH SCHOOL COURSE PLANS.
IN THE 10TH GRADE, THE REQUIRED COURSES ARE---

ENGLISH 2
CONTEMPORARY WORLD HISTORY AND GEOGRAPHY
PHYSICAL EDUCATION

WHAT OTHER COURSES WOULD YOU LIKE TO TAKE NEXT YEAR?
LOOK AT THE LIST OF COURSES.
WHEN YOU HAVE DECIDED WHAT COURSES YOU WANT TO TAKE, TYPE YES.
IF YOU CAN'T MAKE UP YOUR MIND AT ALL TYPE NO

**** YES
GOOD.
TYPE THE CODE NUMBER OF EACH COURSE YOU WANT TO TAKE.
TYPE CR AFTER EACH NUMBER.
WHEN YOU ARE ALL THROUGH, TYPE / AND CR.

**** 70

**** 93

**** 111

**** /
OK, HERE IS THE PROGRAM YOU HAVE PROPOSED

ENGLISH 2
CONTEMPORARY WORLD HISTORY AND GEOGRAPHY
PHYSICAL EDUCATION

FRENCH 1
MATH M 1
BIOLOGY 1

ARE YOU SATISFIED WITH THIS PROGRAM?
IF SO, TYPE YES
IF YOU WOULD LIKE TO CHANGE IT, TYPE CHANGE

**** YES
OK.....
THAT LOOKS LIKE A PRETTY GOOD 10TH GRADE PROGRAM.
DO YOU ANTICIPATE TAKING ANY SUMMER COURSES THAT YEAR?

**** NO
OK.....
AT THE 9TH GRADE YOUR PROJECTED 11TH AND 12TH GRADE SCHEDULE IS
CONSIDERED TO BE TENTATIVE. FIRM DECISIONS CAN BE MADE
ONLY ON THE BASIS OF YOUR YEAR BY YEAR PERFORMANCE.
WHAT YOU DECIDE TO TAKE IN THE 11TH AND 12TH GRADES
WILL BE GOVERNED LARGELY BY WHAT IT IS YOU WANT TO DO AFTER
HIGH SCHOOL. SINCE A PERSON'S PLANS TEND TO CHANGE OVER A
PERIOD OF TIME, YOU SHOULD SEE YOUR COUNSELOR TOWARD THE END OF
YOUR 10TH YEAR IN ORDER TO EVALUATE YOUR 11TH AND 12TH
GRADE PROGRAM IN THE LIGHT OF YOUR CURRENT GOALS.

ALTHOUGH WE WILL BE TALKING ABOUT TENTATIVE PLANS, WHICH YOU WILL BE
ABLE TO CHANGE, LET'S LOOK AT YOUR HIGH SCHOOL COURSE PLANS AS
YOU SEE THEM NOW.

LET'S THINK ABOUT THE 11TH GRADE.

THE REQUIRED COURSES FOR THE 11TH GRADE ARE---

ENGLISH 3
U.S. HISTORY
P.E.

```
WHAT OTHER COURSES WOULD YOU LIKE TO TAKE IN THE 11TH GRADE?
LOOK AT THE LIST OF COURSES.
WHEN YOU HAVE DECIDED WHAT COURSES YOU WANT TO TAKE, TYPE  YES.
IF YOU CAN'T MAKE UP YOUR MIND AT ALL TYPE  NO

****  YES
GOOD.
TYPE THE CODE NUMBER OF EACH COURSE YOU WANT TO TAKE.
TYPE    CR  AFTER EACH NUMBER.
WHEN YOU ARE ALL THROUGH, TYPE    /  AND   CR.

****  71

****  96

****  43

****  /
OK, HERE IS THE PROGRAM YOU HAVE PROPOSED

   ENGLISH 3
   U.S. HISTORY
   P.E.

   FRENCH 2
   MATH M 25
   CREATIVE WRITING 1

ARE YOU SATISFIED WITH THIS PROGRAM?
IF SO, TYPE  YES
IF YOU WOULD LIKE TO CHANGE IT, TYPE  CHANGE

****  YES
OK.....
THAT LOOKS LIKE A REASONABLE 11TH GRADE PROGRAM.
DO YOU ANTICIPATE TAKING ANY SUMMER COURSES THAT YEAR?

****  YES
GOOD.  TYPE THE CODES OF THOSE COURSES YOU WILL TAKE IN THE SUMMER.
TYPE   CR  AFTER EACH NUMBER.
WHEN YOU ARE ALL THROUGH, TYPE   /  AND   CR.

****  130
```

```
**** /
ALRIGHT.  THAT MEANS THAT IN SUMMER SCHOOL YOU WILL TAKE---

     DRIVER EDUCATION
.NOW LET'S THINK ABOUT THE 12TH GRADE.
THE REQUIRED COURSES FOR THE 12TH GRADE ARE---

    GOVERNMENT 2
    PHYSICAL EDUCATION

(ENGLISH 4 IS NOT REQUIRED, BUT YOU MAY WANT TO TAKE IT.)

WHAT OTHER COURSES WOULD YOU LIKE TO TAKE IN THE 12TH GRADE?
LOOK AT THE LIST OF COURSES.
WHEN YOU HAVE DECIDED WHAT COURSES YOU WANT TO TAKE, TYPE  YES.
IF YOU CAN'T MAKE UP YOUR MIND AT ALL TYPE  NO

****  YES
GOOD.
TYPE THE CODE NUMBER OF EACH COURSE YOU WANT TO TAKE.
TYPE    CR  AFTER EACH NUMBER.
WHEN YOU ARE ALL THROUGH, TYPE   /  AND   CR.

****  72

****  64

****  /
OK, HERE IS THE PROGRAM YOU HAVE PROPOSED

    GOVERNMENT 2
    PHYSICAL EDUCATION

    FRENCH 3
    GIRL'S WOODWORK  S

ARE YOU SATISFIED WITH THIS PROGRAM?
IF SO, TYPE  YES
IF YOU WOULD LIKE TO CHANGE IT, TYPE  CHANGE

****  YES
OK.....
THAT'S A PRETTY GOOD 12TH GRADE PROGRAM.
DO YOU ANTICIPATE TAKING ANY SUMMER COURSES THAT YEAR?

****  NO
IT IS A GOOD IDEA FOR ALL COLLEGE BOUND STUDENTS TO TAKE 4 YEARS
OF ENGLISH.  GIVE THIS SOME THOUGHT.
```

I HOPE THIS INTERVIEW HAS PROVIDED YOU WITH SOME INFORMATION
TO THINK ABOUT IN PLANNING YOUR HIGH SCHOOL PROGRAM.
IT'S BEEN NICE INTERACTING WITH YOU.
THANK YOU, DEBBIE
THIS IS THE END OF THE INTERVIEW

APPENDIX C

DESCRIPTION OF A HYPOTHETICAL MAN-MACHINE COUNSELING SYSTEM

The following description is provided to illustrate in detail how the man-machine counseling system might operate.

The man-machine counseling system consists of seven full-time credentialed counselors, one senior programming analyst, one computer programmer and one secretary. One of the counselors, the head counselor, is also a research psychologist. Each counselor has a comfortable office where he can meet privately with his counselees. Three teletype machines are available for communication with the computer. Each of these machines is housed in a small cubicle where they can be used in private.

The counselors spend most of their time with students in their offices, although the first hour of the day may be spent in retrieving information, making decisions, and scheduling appointments. The programming analyst and the programmer work on new computer programs, which are frequently being developed to improve the system, and on the maintenance of the present system. The secretary functions as receptionist, scheduler, typist, and clerk.

A counselor's typical day proceeds as follows. On first entering the counseling complex, he checks the tracking list. This list, which contains the names of all students who may be in need of help and the names of their counselors, was prepared the previous evening. The tracking list was prepared by a computer program that checks the information on the student-information data base tape to determine whether any new information has been added that indicates students are in need of help. The list is printed out on a printing machine with the students' names grouped according to their counselors. The list also identifies each student's problem. The lists for each counselor are placed in his mailbox so that they are available to him the next morning.

The counselor checks the list to identify the students he wants to see, and the secretary arranges appointments for those students as early as they can be scheduled.

The counselor next reviews his list of scheduled appointments and prepares for his interviews by obtaining an up-to-date report for each student. This is done through a man-machine dialogue via the teletype.

After the counselor types his opening request to the system, the system responds: O.K. WHAT KIND OF FUNCTION IS THIS? The counselor types RETRIEVAL OF STUDENT INFORMATION. The teletype next asks for the name of the first student. Following this, by typing in the appropriate messages, the counselor either asks for specific categories of data or requests the total cumulative

record. After the student information has been printed out by the teletype, the counselor asks the computer to provide him with a list of all the categories of information for which automated appraisals can be made. The teletype types out the following: APPRAISAL CATEGORIES: VOCATIONAL GOALS, EDUCATIONAL PLANS, EDUCATIONAL PROBLEMS, PERSONAL PROBLEMS, ASSETS, WEAKNESSES, COUNSELING PRIORITY, COUNSELING PROGNOSIS, DIRECTION AND NATURE OF CHANGES, ANALYSIS OF AUTOMATED DIAGNOSTIC INTERVIEW, etc. The counselor types the name of each student and specifies the appraisal categories appropriate to each student. The teletype types out the appropriate appraisal reports for each student.

The counselor studies the new information and decides which students he will see for counseling and which students will take automated interviews. He types a message to the computer saying that he now wants to prepare the computer for the student interviews and indicates kind of interview to be conducted for each student. For some students the message will be: CONDUCT EDUCATIONAL PLANNING FOR NEXT SEMESTER. For others, the messages will be: CONDUCT STUDY APPROACH DIAGNOSTIC INTERVIEW, or CONDUCT PRELIMINARY VOCATIONAL COUNSELING INTERVIEW.

The counselor gives the secretary the list of students who are to take automated interviews. When students come to the counseling center, they first report to the secretary who directs them to the counselor or to a teletype.

The students who are assigned to the automated interviews type in their names. The computer checks to make sure the student is actually scheduled for this time. If he is, the student continues with the interview in a manner similar to that described on page 6 of this document. The computer terminates the interview if the student makes responses indicating that the automated interview is not appropriate and the student should see the counselor.

The computer makes a record of all student interviews and stores on a recording tape all responses suggesting that the counselor should take some follow-up action. Each evening, these recordings are printed out on the off-line printer and are placed in the counselor's message box for the next day.

When the students have completed the automated interview, they report back to the secretary. If they wish to see the counselor or the counselor desires to see them, they wait to see the counselor or make another appointment. Some counselors want their students to be able to get information about themselves when they want it. However, the students must check with the secretary before using the machines.

Teachers also use the teletype to insert information on student progress. The teachers have been instructed to insert test scores and other kinds of data descriptive of student behavior into the student-information data base when they become available.

Counselors also put information into the student-information data base. These inputs relate to things that the counselor has learned in the interviews, such as the description of special problems or the fact that a decision of a particular kind has been made. These data also are input into the system by means of the teletype. From time to time, counselors contact the programming analyst and the head counselor because they want to modify the system. They may have a new hypothesis that they would like to have printed out in the appraisal program whenever the appropriate data are found in student records; or they may want to make a change in the interview. The counselors conduct an active research program in which they test their procedures and modify them to achieve better performance. The automated procedures permit counselors to conduct a systematic research program that would have been impossible before the computer was added to the system.